D&D Toolbox Project - Technology Demonstration of Fixatives Applied to Hot Cell Facilities via Remote Sprayer Platforms

Challenge

Many facilities slated for D&D across the DOE complex pose hazards (radiological, chemical, and structural) which prevent the use of traditional manual techniques. Efficient and safe D&D of the facilities will require the use of remotely operated technologies. In addition, the D&D of a hot cell facility requires that each of the hot cells be cleaned and stabilized to allow demolition to occur while maintaining worker radiation exposure ALARA and without spreading radioactive contamination. Dozens of hot cell facilities, containing over a hundred highly contaminated hot cells, will require safe and effective D&D. One typical step in the D&D process consists of applying a fixative coating (or similar material) to hot cell surfaces to hold contamination in place during hot cell demolition. A study on available remote technologies for D&D activities, performed by Florida International University's Applied Research Center (FIU-ARC) and NuVision Engineering, indicated that there were no remotely operated technologies available to meet the need for the remote application of strippable/fixative coatings (ORNL Remote Operations for D&D Activities, March 2007). This gap between the identified needs and the available technologies is especially critical for hot cell facilities, where access is typically very limited and radioactive contamination and dose rates are high.

Technical Solution

The objective of the D&D Toolbox Project is to use an integrated systems approach to develop a suite of D&D technologies (D&D toolbox) that can be readily used across the DOE complex to reduce technical risks, improve safety, and limit uncertainty within D&D operations. In supporting this initiative FIU assists in identifying technologies suitable to meet specific facility D&D requirements, assessing the readiness of those technologies for field deployment, and conducting technology demonstration of selected technology. To meet the technology gap challenge for a technology to remotely apply strippable/fixative coatings, a remote fixative sprayer platform was identified and selected for integration with a commercially available remotely operated platform. FIU collaborated with ORNL in identification and selection of typical fixatives and the development of a design for a hot cell mockup facility at FIU. The hot cell mockup facility was built by FIU where the integrated remote spray/remote climber technology was demonstrated in a scenario of remotely entering a facility to spray a fixative to immobilize loose/removable contamination.

Integrated remote fixative spraying platform - climbing up a vertical wall in mock hot cell and applying fixative to ceiling [note trailing tether].

Site Project & Identifier	Tech Stage: Demonstration
D&D Toolbox – FIU Tech Demo	**FIU Technology Demonstration -** Selected technology platform(s) was demonstrated at the hot cell mockup facility at the FIU's Applied Research Center tech demo site in Miami, FL.

Tech Accomplishment

FIU conducted a demonstration, at their mock hot cell, of a remote fixative sprayer platform that was integrated onto an existing remote platform developed by International Climbing Machine (ICM). This integrated platform has the capability of climbing up vertical surfaces. The ICM system was selected for the initial technology demonstration based on the company's work experience in nuclear decontamination, technology capabilities, and previous technology demonstrations. The integrated technology platform was successfully demonstrated to remotely enter into a mock hot cell facility and to spray a fixative on the ceiling, walls, and floor surfaces. The spraying rate for the remote sprayer platform ranged from 3.4 to 4.3 square-feet per minute based on area covered, spraying time, and product used. A final report was prepared to document the findings of this technology demonstration and the results were presented at the Waste Management 2009 Conference. In addition, all information and data gathered will be incorporated into the web-based D&D Knowledge Management Information Tool (D&D KM-IT) and distributed to Hanford's ALARA Center for complex-wide distribution.

Impact

Remotely operated technologies have proven to be an effective means of protecting workers and minimizing dose in hostile environments during D&D activities. A technology platform to perform the remote application of strippable/fixative coatings will meet a high-priority need for ORNL and other facilities across the DOE complex. More than 50 hot cells await D&D at ORNL and well over 100 complex-wide.

Impact and Features

The integrated remote fixative spraying technology platform:

- Closes an identified technology gap
- Reduces worker risk - protects workers by performing D&D activity remotely in hot cells with potential dose rates ranging up to hundreds of R/hr (Roentgens per hour)
- Presents Cost savings – associated with not having to utilize multiple human entries using expensive personal protective equipment; supports D&D activities that will reduce S&M costs
- Reduces Environment risk – by fix loose/removable contamination there is a reduction in radiation exposure and risk of contamination spreading beyond its contained area

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Challenge Category	Tech Solution Category
• Facility Stabilization • Deactivation	• Robotic and Remote Systems • Waste Handling and Packaging • Fixatives, Coatings, & Encapsulation